

REMARKS

Applicants respectfully traverse and request reconsideration.

Claims 1-3, 6-8, 21-23 and 26-28 stand rejected under 35 USC § 103(a) as being unpatentable over U.S. Patent No. 5,720,019 (“Koss”) in view of U.S. Patent No. 6,052,129 (“Fowler”).

The April 2003 Office Action, in the “Response to Arguments” section, cites Fowler as disclosing Applicants’ claimed “discard clip guard band.” The Office Action states that Fowler teaches the discard clip guard band by “introducing the clip guard band region,” and cites Figure 6 as disclosing this. However, it appears that Fowler merely teaches using a type of “trivial accept guard band” as in other prior art systems. Fowler teaches using a standard trivial accept guard band to identify problem polygons (i.e., those outside of the guard band) that are then buffered for later processing, while the standard graphics processing continues without the need for periodically reformatting data and performing clipping (Col. 3, Lines 31-54).

The Applicants have amended independent claims 1, 11, 21, and 29 to include inherent language relating to the claimed discard clip guard band. As used throughout the specifications, the discard clip guard band lies within the trivial accept guard band (see Pg. 6-7 and Pg. 4, lines 25-27). As such, the amendments to the claims are not narrowing limitations. However, if the Patent Office is of a different opinion, the Applicants request notice in writing of same.

As to claims 1 and 2, the Applicants claim a discard guard band that is defined as lying within a trivial accept guard band. The Applicants acknowledge that the trivial accept guard band is considered known in the art to reduce the number of clipping operations that must be performed on primitives in order to generate the displayed image (Pg. 4, Line 29 – Pg. 5, Line 2). The Applicants claim a non-obvious discard clip guard band (Figure 2, Element 30) that issued in addition to the trivial accept guard band. The Applicants’ specification states that “by including a trivial discard guard band in the determination as to whether to trivially discard specific primitives, primitives that have

no area in a pure mathematical sense, but do produce a rasterization area that may include a number of displayed pixels, are not discarded.”

The inclusion of both the trivial accept and the trivial discard guard band is not taught or suggested by the Koss and Fowler references and the prior art. The Fowler reference does not teach a trivial discard guard band as claimed by the Applicant. The Fowler reference would discard primitives having vertices lying outside of the display area, but that still produce a rasterization area that may include a number of displayed pixels. The Applicant’s invention overcomes this shortcoming found in the Fowler reference and other prior art.

With respect to Claim 1, the Applicants respectfully believe that no combination of the Koss reference or the Fowler reference discloses the Applicants’ claimed invention. The Applicants agree with the Office Action that admits Koss does not teach, inter alia, a discard clip guard band for clipping processing. The Office Action cites Koss in view of Fowler as disclosing a method of comparing at least one vertex with X, Y and Z clip values to determine an X, Y and Z clip code where the X, Y and Z clip values correspond to the minimum and maximum X, Y and Z values for the display space scaled to include a discard clip guard band (horizontal or vertical). However, while Koss teaches a method of comparing a vertex coordinate value to a minimum and maximum extent value of the display screen, Koss fails to teach clip values scaled to include a discard clip guard band as claimed by Applicants.

Also, as noted above, Fowler discloses a guard band that is inherently different from a horizontal or vertical discard clip guard band. The guard band of Fowler is referenced by Applicants as a trivial accept guard band (Figure 1 of Specification) and is considered known in the art to reduce the number of clipping operations that must be performed on primitives in order to generate the displayed image (Pg. 4, Line 29 – Pg. 5, Line 2). The Applicants’ claimed invention relies upon a non-obvious trivial discard guard band (Figure 2, Element 30), constructed from the horizontal and vertical discard clip guard bands, that expands the display screen minimum and maximum coordinate

values. The claimed trivial discard guard band allows the discarding of primitives that would otherwise be processed using only a trivial acceptance band as taught by Fowler.

In prior art systems line primitive 40 and point primitive 50 of Applicants' Figure 2, whose rasterization area is part of the display area, would often be discarded because their vertices lie outside of the display screen. Koss teaches a system that would trivially discard these two primitives based upon the location of their vertices with respect to the display area. Without a trivial discard guard band, Koss's system would realize unwanted display aberrations (Pg. 6, Lines 14-18). In the Applicants' claimed invention, if the trivial accept guard band was properly sized, both primitives would be properly processed rather than being discarded thereby avoiding the discarding of primitives that contribute to the image data of the frame. The Applicants' claimed method would entail the trivial discard guard band first not rejecting the primitive, and then the trivial accept guard band making an accept decision.

Fowler teaches a method in which line primitive 40 and point primitive 50 (Applicants' Figure 2) would be processed. However, Fowler's system would also process line primitive 60 (Applicants' Figure 2) which contributes no pixel information to the display area and therefore limit system efficiency. The Applicants' claimed invention would discard line primitive 60 because of the X, Y and Z clip code values determined when comparing each vertex to the discard guard band values.

The Applicants respectfully believe that Claim 1 is allowable as any combination of prior art fails to disclose the Applicants' claimed invention. Moreover the motivation to combine Koss and Fowler, as cited by the Office Action, is moot under the pretense that the combination of Koss and Fowler teaches a one guard band clipping system utilizing a high performance comparison circuit. The Applicants' specification serves as the only source for a motivation to combine Koss and Fowler, and is therefore improper.

With respect to Claim 2, the Applicants respectfully restate the relevant remarks from the response to Claim 1 while also adding that Claim 2 is dependant upon an allowable base claim and contains further patentable material. Applicants believe Claim 2 to be allowable.

In regards to Claim 3, the Applicants respectfully restate the relevant remarks made from the response to Claim 1. Specifically, the Applicants note that Fowler does not teach a trivial discard guard band, and therefore does not teach its constituent members, the horizontal or vertical discard clip guard bands. Furthermore, the Office Action cites Fowler Column 6, Lines 7-20 as disclosing discard clip guard bands based on a dimension of a rasterized area of the primitive (triangle). However, this reference merely discussed the use of Fowler's guard bands, different from Applicants' claimed trivial discard guard band, as a way to reduce the number of clipping operations and to increase the number of trivial accepts and rejects. Fowler does not teach or make obvious the Applicants' claimed invention to one of ordinary skill in the art at the time of the invention. In addition, Claim 3 is dependent upon an allowable base claim. The Applicants' believe Claim 3 to be allowable.

With respect to Claim 6, the Applicants respectfully restate the relevant remarks from the response to Claims 1 and 3. The Office Action incorrectly cites Column 8, Lines 20-23 of Fowler as disclosing horizontal and vertical discard clip guard bands corresponding to an amount of dimensional expansion used for processing primitives. The Office Action relates the horizontal discard clip guard band to a z coordinate, the vertical discard clip guard band to a Y coordinate, and the dimensional expansion to an infinitely large guard band W value. As a result, the Applicants respectfully believe that Fowler fails to teach or make obvious the Applicants' claimed invention. In addition, Claim 6 is dependent upon Claim 3, an allowable base claim. The Applicants respectfully believe Claim 6 to be allowable.

As to Claim 7, the Applicants respectfully restate the relevant remarks from the response to Claims 1 and 6. Claim 7 discloses dimensional expansion corresponding to anti-aliasing operations performed on primitives having at least three vertices. The Office Action cites Fowler (Col. 6, Line 28) as teaching this additional patentable material. However, this reference merely states that anti-aliasing can be performed by a rasterizer when the rasterizer has certain state information that affects how triangles are rendered. This is not analogous to the Applicants' claimed invention in which the horizontal and vertical discard clip guard bands are sized to correspond to dimensional

expansion relating to anti-aliasing operations. As a result of this knowledge and the dependency of Claim 7 on allowable Claim 6, the Applicants respectfully believe Claim 7 to be allowable.

In regards to Claim 8, the Applicants restate the relevant remarks from the response to Claim 1. The Office Action cites Fowler (Col. 8, Lines 20-26) as disclosing horizontal and vertical clip guard bands corresponding to dimensions corresponding to a predetermined number of pixels. This reference was also used for Claim 6, and the relevant remarks from the response to Claim 6 also apply to Claim 8. The pre-clipping clip code computation step of Fowler is not analogous to the claim language of Applicants' Claim 8 in which a determined size of the trivial discard guard band may be found acceptable. In such a system, premature discarding of line primitives may occur, but the resulting effect would also be minimal (Page 10, Lines 11-18). Fowler's pre-clipping code computation step refers to process in which clip codes are generated or computed for the clip testing process (Col. 2, Lines 13-23). In addition, Claim 8 is dependant on Claim 1, an allowable base claim.

With respect to Claim 21, the Applicants respectfully restate the relevant remarks for Claim 1 as Claim 21 corresponds to a primitive processor comprising a processing module and operating instructions stored in memory able to perform the methods described in Claim 1. As such the Applicants respectfully believe Claim 21 to be allowable.

Claims 22, 23 and 26-28 correspond to the primitive processor able to execute the methods described in Claims 2, 3 and 6-8, respectively, and are therefore believed to be allowable per the relevant remarks made above.

Claims 4, 5, 24 and 25 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,720,019 ("Koss") in view of U.S. Patent No. 6,052,129 ("Fowler") and further in view of U.S. Patent No. 5,012,433 ("Callahan").

With respect to Claim 4, the Office Action cites Callahan as disclosing the language of Claim 4 in which the Applicants' method of Claim 1 relies upon horizontal

and vertical discard clip guard bands based on one-half of a smaller dimension of the rasterized area of a line primitive. The Applicants respectfully restate the relevant remarks made in response to Claims 1 and 3, and furthermore note that Column 7, Lines 8-25 of Callahan do not disclose the Applicants' claimed invention. Rather, this reference is specifically directed to the process of the first clipping stage in which the system removes all graphic primitives which lie outside of an arbitrary clipping volume or window (often larger than the desired clipping volume). Callahan is silent as to trivial discard guard bands and their constituent members, the horizontal and vertical discard clip guard bands. Furthermore, Callahan is silent as to basing the horizontal and vertical discard clip guard bands upon one half of a smaller dimension of the rasterized area of the line. As a result, Callahan does not make obvious the Applicants' claimed invention, and the Applicants respectfully believe that Claim 4 is allowable as it contains further non-obvious patentable material.

In regard to Claim 5, the Applicants claim the method of Claim 1 and 3 in which the horizontal and vertical discard clip bands are based on a radial dimension of the rasterized area of a point primitive. This is not analogous to Koss in view of Callahan. Koss does disclose clipping preprocessing for various polygon primitives (triangle, line, and point), but is silent as to any type of discard clip bands. Furthermore, while Callahan teaches a method of clipping inclusive of the rasterized area of a point primitive, Callahan is also silent on discard clip bands. The Applicants restate the relevant remarks in response to Claims 1, 3, and 4, and believe Claim 5 is allowable as it contains further non-obvious patentable material.

Claims 24 and 25 are in reference to the primitive processor able to execute instructions stored in memory corresponding to the functions described in Claims 4 and 5. As Claims 4 and 5 are allowable, Claims 24 and 25 are also believed to be allowable.

Claims 9, 10, 29 and 30 stand rejected under 35 U.S.C. §103(a) as being unpatentable over four different references namely, U.S. Patent No. 5,720,019 ("Koss") in view of U.S. Patent No. 6,052,129 ("Fowler") and further in view of U.S. Patent No. 5,369,741 (Hartog) and U.S. Patent No. 6,359,630 (Morse).

With respect to Claim 9, the Applicants respectfully restate the relevant remarks made in response to Claim 1 with respect to the Fowler reference; accordingly this claim is allowable. In addition, their combination with Hartog and Morse fails to disclose the Applicants' claimed invention. Hartog relies upon two sets of generated outcodes describing the location of a line segment via its endpoints. While Hartog relies upon two separate areas or boxes (in addition to the display area) to make logical decisions (draw, reject, or process), the Applicants' claimed invention, upon notice that a trivial reject is not possible from the trivial discard guard band comparison, relies upon only the trivial accept guard band (comprised of both the horizontal and vertical accept clip guard bands) to make a trivial accept decision (Page 10, Line 25-Page 11, Line 6).

Morse teaches three-dimensional graphics processing via a three-dimensional graphics pipeline and furthermore discloses a method of clipping primitives. However all combinations of Koss, Fowler, Hartog and Morse fail to disclose the Applicants' claimed invention. As stated in response to Claim 1, Koss and Fowler fail to teach the Applicants' claimed invention. Moreover, the teachings of Koss in view of Fowler and further in view of Hartog and Morse would also not yield the claimed invention. Koss teaches a system that compares coordinate values to the dimensions of a display space without discard guard bands as accepted by the Office Action, while Fowler teaches a single guard band for optimized processing in prior art. Hartog discloses a method for pre-clipping a line lying within a clipping rectangular region which is a subset of a region of a display screen. In such a system line primitive 40 (Figure 2, Element 40 of Applicant) would be rejected by equation (3) producing a logical true. When condition (3) is true, the line is rejected and no further processing takes place on the line (Col. 5, Lines 49-57). The Applicants' claimed invention would allow line primitive 40 because of its pixel contribution to the display space. While Morse does teach of a pipeline and a rendering unit able to clip a primitive (prior art acknowledged by Applicants; Page 13, Lines 14-16), the combination of Morse with Hartog, Koss and Fowler again fails to yield the Applicants' claimed invention. Instead, the teachings of Koss and Fowler teach away from those of Hartog and Morse. Claim 9 is furthermore dependant upon allowable Claim 1 and contains further non-obvious patentable material. The Applicants respectfully believe Claim 9 to be allowable.

With regard to Claim 10, the Applicants respectfully restate the relevant remarks from Claim 1 and Claim 9. Specifically, the Applicants assert that neither Hartog or Morse disclose the Applicants' claimed invention where first a trivial discard guard band decides if the primitive can be discarded, and then where the trivial accept guard band (Claims 9 and 10) decides if the primitive can be trivially accepted. The Office Action equates the Applicants' vertical accept clip guard band to the guard band clipping boundary of Morse (Figure 4, Element 314) and furthermore equates the Applicants' vertical accept clip guard band to the regular clipping boundary of Morse (Figure 4, Element 312). However, the regular clipping boundary (Element 312) of Morse simply marks the boundary of the display screen while the vertical discard clip guard band is a scaled vertical boundary of the display screen as stated above. In no embodiment of Morse does a vertical or horizontal discard clip band exist. The Applicants respectfully believe that Claim 10, also dependent upon allowable Claim 9 and containing further patentable material, is allowable.

Claims 29 and 30 are in reference to the primitive processor able to execute instructions stored in memory corresponding to the functions described in Claims 9 and 10. Also, Claim 29 has been amended to include inherent language. Therefore, as Claims 9 and 10 are allowable, Claims 29 and 30 are also believed to be allowable.

Claims 11-15 stand rejected under 35 USC § 103(a) as being unpatentable over U.S. Patent No. 5,720,019 ("Koss") in view of U.S. Patent No. 6,111,584 ("Murphy").

In reference to Claim 11, the Applicants respectfully restate the relevant remarks for Claim 1 with respect to a discard clip guard band. As stated above, Fowler does not teach a discard clip guard band. Furthermore, Murphy also does not teach a discard clip guard band. Therefore any combination of the two references would not teach the Applicant's claimed invention.

While Murphy teaches a host processor or geometry engine able to translate each primitive into a set of fragments, for argument's sake, the combination of Koss in view of Murphy would only produce a computer graphics system having high performance primitive clipping preprocessing able to compare coordinate vales of primitive vertices to

coordinate values of clip regions not scaled to include a discard clip guard band, clip if necessary, and then translate the clipped primitives into a set of fragments. The Office Action fails to provide both motivation to combine Koss and Murphy and furthermore fails to include a reference that teaches a discard clip guard band. As a result, the Applicants respectfully believe Claim 11 to be allowable.

Applicants respectfully restate the relevant remarks from the response to Claim 11 and believe Claims 12-14, all dependent upon allowable Claim 11, to be allowable. Specifically, Koss fails to teach a graphics processing circuit comprising a clip code generator able to compare coordinates for vertices of the clip-space primitive with screen space coordinates scaled by a discard clip guard band as stated on page 4 of the Office Action. In addition, all combinations of Koss and Murphy fail to yield the claimed invention and all motivations to combine are invalid.

Claim 15, dependent upon allowable Claim 11, is also believed to be allowable as Koss again fails to teach a graphics processing circuit capable to compare coordinate values in consideration of Frustum clip planes scaled by an accept clip guard band.

Claim 16 stands rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,720,019 ("Koss") in view of U.S. Patent No. 6,111,584 (Murphy) and further in view of U.S. Patent No. 6,359,630 (Morse); Claims 17 and 20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,720,019 ("Koss") in view of U.S. Patent No. 6,111,584 (Murphy) and further in view of U.S. Patent No. 6,052,129 ("Fowler"); and Claims 18 and 19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,720,019 ("Koss") in view of U.S. Patent No. 6,111,584 ("Murphy") in view of U.S. Patent No. 6,052,129 ("Fowler") and further in view of U.S. Patent No. 5,012,433 (Callahan).

Claims 16, 17, 18, 19 and 20 correspond to the graphics processing circuit claims of allowable method Claims 10, 3, 4, 5 and 8, respectively. Furthermore, Claims 16-20 are also ultimately dependent upon allowable Claim 11. The Applicants respectfully restate the relevant remarks from Claims 10, 3, 4, 5, 8 and 11 and believe Claims 16-20 to also be allowable.


In general, Claims 11-20 are in reference to the graphics processing circuit able to process the methods described in Claims 1-10. The Office Action has failed to provide any motivation that would allow the prior art references to be combined in such a manner as to yield the Applicants' claimed invention. The only motivation to produce the claimed invention comes from hindsight analysis of the Applicants' specification. As Claims 1-10 are allowable, Claims 11-20 are also believed to be allowable.

Applicants respectfully submit that the claims are now in condition for allowance and an early Notice of Allowance is earnestly solicited. The Examiner is invited to telephone the below-listed attorney if the Examiner believes that a telephone conference will expedite the prosecution of the application.

Date: May 29, 2003

Vedder Price Kaufman & Kammholz
222 N. LaSalle Street, Suite 2600
Chicago, IL 60601
PH: (312) 609-7599
FAX: (312) 609-5005

Respectfully submitted,


Christopher J. Reckamp
Reg. No. 34,414